

We claim:

1. A bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta, comprising:

5 a tubular body having:

a lower extremity; and

10 an upper proximal extremity to be sutured to a proximal neck of the aorta;

a pair of tubular branches diverging from said lower extremity of said body and ending in corresponding distal portions;

15 said tubular body and said tubular branches being of a vascularly implantable material; and

retaining members secured to said distal portions.

20 2. The vascular prosthesis according to claim 1, wherein:

said retaining members are two stents; and

25 each of said stents is formed of a tubular portion of expandable metal mesh of a biocompatible material.

3. The vascular prosthesis according to claim 1, wherein:

    said retaining members are two stents; and

5 each of said stents is fixed respectively within each extremity of said distal portions and is at least partly covered by said material.

4. A bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta, comprising:

a Y-shaped prosthesis body of a material implantable in

5 vessels having:

a body portion with a lower extremity and an upper extremity to be sutured to a proximal neck of the aorta; and

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a tubular branches respectively diverging away from said lower extremity and ending in corresponding distal portions; and

15 retaining members secured to said distal portions.

5. The vascular prosthesis according to claim 4, wherein said retaining members are expandable retaining members.

20 6. The vascular prosthesis according to claim 4, wherein said retaining members are two stents.

7. The vascular prosthesis according to claim 6, wherein each of said stents is formed of a tubular portion of expandable 25 metal mesh of a biocompatible material.

8. The vascular prosthesis according to claim 4, wherein each of said stents is fixed respectively within each extremity of said distal portions and is at least partly covered by said material.

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9. The vascular prosthesis according to claim 6, wherein each of said stents is fixed respectively within each extremity of said distal portions and is at least partly covered by said material.

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10. A delivery system for release of a prosthesis having anchoring stents, comprising:

a pair of releasing balloon catheters each having:

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an inflatable balloon adapted to be inserted within a corresponding stent of the prosthesis and to continue adhering thereto throughout a time prior to release thereof;

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a self-supporting tube defining a single lumen and having a first diameter and two opposing ends;

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a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends, fluidically connecting said lumen with said inflatable balloon, and connecting said inflatable balloon to said tube for passing liquid to inflate said inflatable balloon; and

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a terminal connection fluidically connected to said lumen at a second of said ends;

25 a pair of inflating syringes each having a connection for releasable attachment to said terminal connection of a respective one of said releasing catheters and for fluidically

connecting a respective one of said syringes to said inflatable balloon to inflate said inflatable balloon and thereby release a respective stent;

5 a pair of guiding balloon catheters each having:

a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said releasing catheter therethrough, said dilator having:

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a proximal portion having an outer fourth diameter larger than said inner third diameter and being fitted with a haemostatic valve;

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a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

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an elongated distal portion tapering for retrieval in an aorta; and

a tubular sheath having:

distal ends;

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an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

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a second tube running eccentrically outside said sheath and terminating in a portion for connection to one of said inflating syringes; and

10 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

15 introducers fitted with valves for each of said guiding catheters.

11. The delivery system according to claim 10, wherein each of said releasing catheters has a set of hooks adapted to be captured within a corresponding stent of the vascular 20 prosthesis and to remain adhering thereto throughout a time preceding inflation of said inflatable balloon.

12. The delivery system according to claim 10, wherein: 25 each of said releasing catheters has a set of hooks corresponding to a shape of said inflatable balloon; and

said hooks are adapted to be captured within the corresponding stent of the prosthesis and to remain adhering thereto throughout a time preceding inflation of said inflatable 5 balloon for release.

13. The delivery system according to claim 10, wherein:

said tube of said releasing catheters is threaded; and

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said connection of each of said inflating syringe is correspondingly threaded for connection to said tube.

14. The delivery system according to claim 10, wherein said 15 sheath is externally marked in centimeters and has a selective moving ring system adapted to be immobilized on a respective one of said introducers.

15. The delivery system according to claim 10, wherein said 20 sheath is externally marked in centimeters and has an immobilizer locking said sheath on a respective one of said introducers.

16. A delivery system for releasing a prosthesis having anchoring stents, comprising:

a pair of releasing balloon catheters each having:

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an inflatable balloon adapted to be removably inserted within a portion of the prosthesis;

10 a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

15 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

20 a terminal connection fluidically connected to said lumen at a second of said ends;

25 a pair of inflating syringes each having a connection for releasable attachment to said terminal connection of a respective one of said releasing catheters and, when connected thereto, fluidically connecting a respective one of said syringes to said inflatable balloon;

a pair of guiding balloon catheters each having:

5 a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said releasing catheter therethrough, said dilator having:

10 a proximal portion having an outer fourth diameter larger than said inner third diameter;

15 a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

20 a distal portion tapering for insertion into a vessel; and

25 a tubular sheath having:

distal ends;

an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

a second tube extending away from said sheath and terminating in a portion for connection to one of said inflating syringes; and

5 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and  
introducers for introducing each of said guiding catheters  
10 into a patient.

17. The delivery system according to claim 16, wherein each of said releasing catheters has a set of hooks adapted to be captured within a corresponding stent of the vascular  
15 prosthesis for adhering said hooks to the prosthesis.

18. The delivery system according to claim 16, wherein:  
at least one of said tubes of said releasing catheters is  
20 threaded; and

said connection of at least one of said inflating syringes is correspondingly threaded for connection to said at least one tube.

19. The delivery system according to claim 16, wherein said sheath is externally marked.

20. The delivery system according to claim 19, wherein said  
5 sheath has a selective moving ring system adapted to be immobilized on a respective one of said introducers.

21. The delivery system according to claim 19, wherein said sheath has an immobilizer locking said sheath on a respective  
10 one of said introducers.

22. A delivery system for releasing a prosthesis having anchoring stents, comprising:

at least one releasing balloon catheter having:

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an inflatable balloon adapted to be removably inserted within a portion of the prosthesis;

10 a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

15 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

20 a terminal connection fluidically connected to said lumen at a second of said ends;

25 at least one inflating syringe having a connection for releasable attachment to said terminal connection of said releasing catheter and, when connected thereto, fluidically connecting said syringe to said inflatable balloon;

at least one guiding balloon catheter having:

a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said release catheter therethrough, said dilator having:

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a proximal portion having an outer fourth diameter larger than said inner third diameter;

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a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

15

a distal portion tapering for insertion into a vessel; and

a tubular sheath having:

20  
distal ends;

an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

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a second tube extending away from said sheath and terminating in a portion for connection to said syringe; and

5 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and  
at least one introducer for introducing said balloon guiding  
10 catheter into a patient.

23. A method for releasing an aortic prosthesis, which comprises:

positioning an introducer in femoral arteries of a patient;

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providing guiding balloon catheters with depth graduations and balloons;

positioning the guiding catheters through the introducers to  
10 locate the balloons in terminal parts of common iliac  
arteries;

clamping the proximal aorta, inflating the balloons of the  
guiding catheters, and opening the aorta for access from  
15 outside the vessel;

threading distal ends of releasing balloon catheters through  
the guiding catheters and recovering the distal ends of the  
release catheters outside the patient;

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connecting distal ends of releasing catheters to distal  
portions of the prosthesis;

moving the prosthesis until distal portions of the releasing  
25 catheters contact the guiding catheters;

suturing a proximal part of the prosthesis to the aorta;

inflating the balloons of the releasing catheters to fix the distal portions of the prosthesis;

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deflating the balloons of the releasing catheters and removing the releasing catheters;

10 deflating the balloons of the guiding catheters and removing the guiding catheters;

suturing the aorta; and

removing the introducers.

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24. The method according to claim 23, which further comprises introducing guide wires through the introducers.

25. The method according to claim 23, which further comprises 20 maintaining a position of the guiding catheters with the depth graduations viewed on the outside of the introducers.

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26. The method according to claim 23, which further comprises carrying out the releasing catheter threading step by:

5 inserting distal ends of dilators through the guiding catheters;

threading the distal ends of the releasing catheters through lumen of the dilators and recovering the distal ends of the releasing catheters outside the patient; and

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removing the dilators.

27. The method according to claim 26, which further comprises calculating a distance between at least one tip of the dilators and a point for aorto-prosthetic anastomosis and, 15 thereby, determining a length of the vascular prosthesis to be implanted.

28. The method according to claim 27, which further comprises 20 cutting off prosthesis proximal surplus based upon the length determined.

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29. The method according to claim 23, which further comprises:

carrying out the aorta incising step by incising the aneurysm  
5 of the aorta; and

carrying out the aorta suturing step by suturing the aneurysm  
of the aorta.

10 30. The method according to claim 23, which further  
comprises:

disposing anchoring stents at distal portions of the  
prosthesis; and

15 carrying out the connecting step by inflating balloons of the  
releasing catheters within the stents.

31. The method according to claim 23, which further comprises  
20 carrying out the moving step by pulling the releasing  
catheters until the distal portions of the releasing catheters  
approximately abut against distal ends of the guiding  
catheters.

25 32. The method according to claim 23, which further comprises  
closing off the lumbar arteries at the opening of the aorta.

33. A vascular prosthesis delivery kit, comprising:

a pair of releasing balloon catheters each having:

5 an inflatable balloon adapted to be removably inserted within a portion of the prosthesis;

a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

10 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

15 a terminal connection fluidically connected to said lumen at a second of said ends;

20 a pair of inflating syringes each having a connection for releasable attachment to said terminal connection of a respective one of said releasing catheters and, when connected thereto, fluidically connecting a respective one of said 25 syringes to said inflatable balloon;

a pair of guiding balloon catheters each having:

a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said releasing catheter therethrough, said dilator having:

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a proximal portion having an outer fourth diameter larger than said inner third diameter;

10 a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

15 a distal portion tapering for insertion into a vessel; and

a tubular sheath having:

20 distal ends;

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an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

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a second tube extending away from said sheath and terminating in a portion for connection to one of said inflating syringes; and

5 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

introducers for introducing each of said guiding catheters  
10 into a patient.

34. The kit according to claim 33, further comprising a bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta having:

5 a tubular body having:

a lower extremity; and

10 an upper proximal extremity to be sutured to a proximal neck of the aorta;

a pair of tubular branches diverging from said lower extremity of said body and ending in corresponding distal portions;

15 said tubular body and said tubular branches being of a vascularly implantable material; and

retaining members secured to said distal portions.

20 35. The kit according to claim 33, further comprising a bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta having:

25 a Y-shaped prosthesis body of a material implantable in vessels having:

a body portion with a lower extremity and an upper extremity to be sutured to a proximal neck of the aorta; and

5 a tubular branches respectively diverging away from said lower extremity and ending in corresponding distal portions; and

retaining members secured to said distal portions.

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36. A vascular prosthesis delivery kit, comprising:

at least one releasing balloon catheter having:

5 an inflatable balloon adapted to be removably inserted within a portion of the prosthesis;

a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

10 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

15 a terminal connection fluidically connected to said lumen at a second of said ends;

20 at least one inflating syringe having a connection for releasable attachment to said terminal connection of said releasing catheter and, when connected thereto, fluidically connecting said syringe to said inflatable balloon;

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at least one guiding balloon catheter having:

a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said release catheter therethrough, said dilator having:

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a proximal portion having an outer fourth diameter larger than said inner third diameter;

10 a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

a distal portion tapering for insertion into a vessel; and

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a tubular sheath having:

distal ends;

20 an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

a second tube extending away from said sheath and terminating in a portion for connection to said syringe; and

5 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and  
at least one introducer for introducing said balloon guiding  
10 catheter into a patient.

37. The kit according to claim 36, further comprising a bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta having:

15 a tubular body having:

a lower extremity; and

20 an upper proximal extremity to be sutured to a proximal neck of the aorta;

a pair of tubular branches diverging from said lower extremity of said body and ending in corresponding distal portions;

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said tubular body and said tubular branches being of a  
vascularly implantable material; and

retaining members secured to said distal portions.

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38. The kit according to claim 36, further comprising a  
bifurcated vascular prosthesis for curing aneurysms of the  
abdominal aorta having:

10 a Y-shaped prosthesis body of a material implantable in  
vessels having:

a body portion with a lower extremity and an upper  
extremity to be sutured to a proximal neck of the aorta;

15 and

a tubular branches respectively diverging away from said  
lower extremity and ending in corresponding distal  
portions; and

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retaining members secured to said distal portions.

39. A vascular prosthesis delivery kit, comprising:  
a bifurcated vascular prosthesis for curing aneurysms of the  
abdominal aorta having:

5       a tubular body having:

          a lower extremity; and

10      an upper proximal extremity to be sutured to a  
          proximal neck of the aorta;

15      a pair of tubular branches diverging from said lower  
          extremity of said body and ending in corresponding distal  
          portions;

20      said tubular body and said tubular branches being of a  
          vascularly implantable material; and

          retaining members secured to said distal portions;

25      a pair of releasing balloon catheters each having:

          an inflatable balloon adapted to be removably inserted  
          within said retaining members of said prosthesis;

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a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

5 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

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a terminal connection fluidically connected to said lumen at a second of said ends;

15 a pair of inflating syringes each having a connection for releasable attachment to said terminal connection of a respective one of said releasing catheters and, when connected thereto, fluidically connecting a respective one of said syringes to said inflatable balloon;

20 a pair of guiding balloon catheters each having:

a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said releasing catheter therethrough, said dilator having:

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a proximal portion having an outer fourth diameter larger than said inner third diameter;

5 a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

a distal portion tapering for insertion into a vessel; and

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a tubular sheath having:

distal ends;

15 an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

20 a second tube extending away from said sheath and terminating in a portion for connection to one of said inflating syringes; and

25 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

introducers for introducing each of said guiding catheters  
into a patient.

40. A vascular prosthesis delivery kit, comprising:

a bifurcated vascular prosthesis for curing aneurysms of the abdominal aorta having:

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a Y-shaped prosthesis body of a material implantable in vessels having:

10 a body portion with a lower extremity and an upper extremity to be sutured to a proximal neck of the aorta; and

15 a tubular branches respectively diverging away from said lower extremity and ending in corresponding distal portions; and

retaining members secured to said distal portions;

a pair of releasing balloon catheters each having:

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an inflatable balloon adapted to be removably inserted within said retaining members of said prosthesis;

25 a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

5 a terminal connection fluidically connected to said lumen at a second of said ends;

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a pair of inflating syringes each having a connection for releasable attachment to said terminal connection of a respective one of said releasing catheters and, when connected thereto, fluidically connecting a respective one of said 15 syringes to said inflatable balloon;

a pair of guiding balloon catheters each having:

20 a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said releasing catheter therethrough, said dilator having:

a proximal portion having an outer fourth diameter larger than said inner third diameter;

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a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

5 a distal portion tapering for insertion into a vessel; and

a tubular sheath having:

10 distal ends;

an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said 15 cup connection;

a second tube extending away from said sheath and terminating in a portion for connection to one of said inflating syringes; and

20 a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

25 introducers for introducing each of said guiding catheters into a patient.

41. A vascular prosthesis delivery kit, comprising:  
a bifurcated vascular prosthesis for curing aneurysms of the  
abdominal aorta having:

5        a tubular body having:

          a lower extremity; and

10        an upper proximal extremity to be sutured to a  
          proximal neck of the aorta;

15        a pair of tubular branches diverging from said lower  
          extremity of said body and ending in corresponding distal  
          portions;

20        said tubular body and said tubular branches being of a  
          vascularly implantable material; and

25        retaining members secured to said distal portions;

          at least one releasing balloon catheter having:

          an inflatable balloon adapted to be removably inserted  
          within said retaining members of said prosthesis;

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a self-supporting tube defining a lumen and having a first diameter and two opposing ends;

5 a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

10 a terminal connection fluidically connected to said lumen at a second of said ends;

15 at least one inflating syringe having a connection for releasable attachment to said terminal connection of said releasing catheter and, when connected thereto, fluidically connecting said syringe to said inflatable balloon;

at least one guiding balloon catheter having:

20 a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said release catheter therethrough, said dilator having:

25 a proximal portion having an outer fourth diameter larger than said inner third diameter;

a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

5

a distal portion tapering for insertion into a vessel; and

a tubular sheath having:

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distal ends;

an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said cup connection;

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a second tube extending away from said sheath and terminating in a portion for connection to said syringe; and

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a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

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at least one introducer for introducing said balloon guiding catheter into a patient.

42. A vascular prosthesis delivery kit, comprising:  
a bifurcated vascular prosthesis for curing aneurysms of the  
abdominal aorta having:

5 a Y-shaped prosthesis body of a material implantable in  
vessels having:

10 a body portion with a lower extremity and an upper  
extremity to be sutured to a proximal neck of the  
aorta; and

15 a tubular branches respectively diverging away from  
said lower extremity and ending in corresponding  
distal portions; and

20 retaining members secured to said distal portions;

at least one releasing balloon catheter having:

25 an inflatable balloon adapted to be removably inserted  
within said retaining members of said prosthesis;

a self-supporting tube defining a lumen and having a  
first diameter and two opposing ends;

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a cup connection having a second diameter greater than said first diameter, said cup connection being disposed at a first of said ends and connecting said inflatable balloon to said tube to fluidically connect said lumen with said inflatable balloon to pass liquid to inflate said inflatable balloon; and

5 a terminal connection fluidically connected to said lumen at a second of said ends;

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at least one inflating syringe having a connection for releasable attachment to said terminal connection of said releasing catheter and, when connected thereto, fluidically connecting said syringe to said inflatable balloon;

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at least one guiding balloon catheter having:

20 a dilator defining an inner lumen having an inner third diameter sized to pass said tube of said release catheter therethrough, said dilator having:

a proximal portion having an outer fourth diameter larger than said inner third diameter;

a median portion having a substantially constant outer fifth diameter smaller than said outer fourth diameter; and

5 a distal portion tapering for insertion into a vessel; and

a tubular sheath having:

10 distal ends;

an inner sixth diameter at least as great as said outer fifth diameter of said median portion of said dilator and less than said second diameter of said 15 cup connection;

a second tube extending away from said sheath and terminating in a portion for connection to said syringe; and

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a terminal outer balloon connected to said second tube, said terminal outer balloon being disposed at one of said distal ends of said sheath; and

25 at least one introducer for introducing said balloon guiding catheter into a patient.